UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/864,376	05/25/2001	Tadahiro Ohmi	107176-00007	1605

7590 01/09/2008

ARENT FOX KINTNER PLOTKIN & KAHN PLLC
1050 Connecticut Avenue, N.W.
Suite 400
Washington, DC 20036-5339

EXAMINER	
ZERVIGON, RUDY	

ART UNIT	PAPER NUMBER
1792	

MAIL DATE	DELIVERY MODE
01/09/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 09/864,376
Filing Date: May 25, 2001
Appellant(s): OHMI ET AL.

Sheree Rowe
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed October 11, 2007 appealing from the Office action mailed January 11, 2007.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal – Brief's "Grounds of Rejection"

The appellant's statement of the grounds of rejection to be reviewed on appeal is substantially correct. The changes are as follows:

With respect to claim 14, Applicant states:

"claim 14 as being unpatentable over Tokuda, Otsubo, and Ohmi in view of Tsuchihashi and further in view of Masaaki et al. (U.S. Patent No. 6,109,208, hereinafter "Masaaki")".

However, claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tokuda; Mitsuo et al (U.S. 5,134,965 A), Otsubo et al (USPat. 4,985,109), and Ohmi; Tadahiro et al. (US 6,830,652 B1) in view of Tsuchihashi, Masaaki et al (USPat. 6,109,208). As can be seen from the Examiner's rejections, the Examiner's citation is stated as last name followed by first name. Thus Tsuchihashi is the last name and Masaaki is the first name of USPat. 6,109,208.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

US 6830652 B1	Ohmi; Tadahiro et al.	12-2004
US 6109208 A	Tsuchihashi; Masaaki et al.	08-2000
US 5134965 A	Tokuda; Mitsuo et al.	08-1992
US 4985109 A	Otsubo; Toru et al.	01-1991

(9) Grounds of Rejection

The following grounds of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1-5, 7, 8, 9, 12, and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tokuda; Mitsuo et al (U.S. 5,134,965 A) in view of Otsubo et al (USPat. 4,985,109) and Ohmi; Tadahiro et al. (US 6,830,652 B1). Tokuda teaches a plasma processing apparatus (Figure 13) including:

i. A processing chamber (6, Figure 13; column 13, line 16 - column 14, line 5)

ii. A microwave slot antenna (34, Figure 13; column 13, line 16 - column 14, line 5) radiating antenna / radiating surface (lower surface of 34, Figure 13)

iii. A plate-shaped dielectric body (5, Figure 13; column 13, line 16 - column 14, line 5)

iv. A distance "D" (" t ", Figure 13; column 11; lines 11-25) between the microwave radiating antenna surface (lower surface of 34, Figure 13) and a surface (upper surface of 5; Figure 13) of the dielectric body (5, Figure 13; column 13, line 16 - column 14, line 5) is shown by Tokuda et al in Figure 2

v. Tokuda et al teaches a dielectric plate as discussed above

vi. Tokuda further teaches the plasma (column 3; lines 58-67) is formed between the plasma exciting surface (lowest surface of 5, Figure 13; column 13, line 16 - column 14, line 5) and the object (8; Figure 13) to be processed – claim 1

vii. Tokuda further teaches forming a standing wave microwave (column 14; lines 30-45) between Tokuda's microwave radiating surface (lower surface of 34, Figure 13) and his plasma exciting surface (lowest surface of 5, Figure 13; column 13, line 16 - column 14, line 5).

viii. Tokuda further teaches relative spacing (" t ", Figure 13; column 11; lines 11-25) between Tokuda's plate-shaped dielectric body (5, Figure 13; column 13, line 16 - column 14, line 5) and Tokuda's plasma radiating surface (lower surface of 34, Figure 13).

Tokuda does not teach a specific thickness "d2" (Applicant's Figure 1) for his dielectric plate. Tokuda does not teach a slot antenna where a part of the number of slots is closed. Tokuda does not teach only one microwave slot antenna, as claimed by claim 1,2,7,8,16,17,23, and 24.

Tokuda is silent with respect to if one end of a standing wave microwave (column 14; lines 30-45) is positioned on Tokuda's plasma exciting surface (lowest surface of 5, Figure 13; column 13, line 16 - column 14, line 5), as claimed by claim 1, 2, 7, 8, 16, 17, 23, and 24.

Otsubo teaches a concentric slot antenna (Figure 2) in a microwave plasma reactor (Figure 1) having a number of slots (5a) formed and distributed in the microwave radiating surface where a part of the number of slots can be closed (column 7, lines 3-15). Otsubo teaches only one microwave slot antenna (Figure 2), as claimed by claim 1,2,7,8,16,17,23, and 24.

Ohmi teaches one end of a standing wave microwave is positioned on Ohmi's plasma exciting surface (top surface of 103; Figure 1), as claimed by claim 1, 2, 7, 8, 16, 17, 23, and 24 – "In order to prevent the discharge, the thickness of the dielectric material shower plate 103 is determined so that the gap is located at a position of a node of the standing wave of the microwave electric field. " (column 12, line 66 – column 13, line 20).

It would have been obvious to one of ordinary skill in the art at the time the invention was made for Tokuda to optimize the relative positions/thickness of Tokuda's dielectric plate (5, Figure 13; column 13, line 16 - column 14, line 5) with Tokuda's microwave slot antenna (34, Figure 13; column 13, line 16 - column 14, line 5), inclusive, to condense Tokuda's plural microwave slot antenna with Otsubo's single slot antenna.

Motivation Tokuda to optimize the relative positions/thickness of Tokuda's dielectric plate (5, Figure 13; column 13, line 16 - column 14, line 5) with Tokuda's microwave slot antenna (34, Figure 13; column 13, line 16 - column 14, line 5), inclusive, to condense Tokuda's plural microwave slot antenna with Otsubo's single slot antenna is for optimizing the space "between the slot antenna and the quartz window 4 through which the microwaves pass so that the

microwaves emitted from the slot antenna have room to expand" (column 9, lines 6-30) as taught by Otsubo, further, motivation for Tokuda to use Otsubo's slot antenna under standing wave microwave propagation is for "easy" plasma generation as taught by Otsubo (column 19, lines 35-40). Motivation for optimizing apparatus thicknesses is for forming stable plasmas as taught by Ohmi (column 13, lines 6-15). Further, it is well established that the rearrangement of parts is considered obvious to those of ordinary skill (In re Japikse , 181 F.2d 1019, 86 USPQ 70 (CCPA 1950); In re Kuhle , 526 F.2d 553, 188 USPQ 7 (CCPA 1975); Ex parte Chicago Rawhide Manufacturing Co. , 223 USPQ 351, 353 (Bd. Pat. App. & Inter. 1984).; MPEP 2144.04). Further, it is established that the use of a one piece construction instead of interconnected components is obvious (In re Larson, 340 F.2d 965, 968, 144 USPQ 347, 349 (CCPA 1965), MPEP 2144.04).

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tokuda; Mitsuo et al (U.S. 5,134,965 A), Otsubo et al (USPat. 4,985,109), and Ohmi; Tadahiro et al. (US 6,830,652 B1) in view of Tsuchihashi, Masaaki et al (USPat. 6,109,208). Tokuda, Otsubo, and Ohmi are discussed above. Tokuda, Otsubo, and Ohmi do not teach plural slots of the microwave radiating antenna where the plural slots in the peripheral direction are closed. Tsuchihashi teaches a similar microwave plasma generating device (Figure 20, 21; column 11, lines 37-49) including plural slots ("slits" 6a-d, 10a-d) in the peripheral direction of the shutter antenna (26) where portions of the slots ("slits" 6a-d) in the peripheral direction can be opened ("A" direction; Figure 20) or closed (counter to "A" direction; Figure 20).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to replace Tokuda and Otsubo's microwave radiating antenna with Tsuchihashi's shutter antenna as taught by Tsuchihashi.

Motivation to replace Tokuda and Otsubo's microwave radiating antenna with Tsuchihashi's shutter antenna as taught by Tsuchihashi is for distributing microwaves as taught by Tsuchihashi to form high density plasmas (column 11, lines 37-49).

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tokuda; Mitsuo et al (U.S. 5,134,965 A), Otsubo et al (USPat. 4,985,109), and Ohmi; Tadahiro et al. (US 6,830,652 B1) in view of Tsuchihashi, Masaaki et al (USPat. 6,109,208). Tokuda, Otsubo, and Ohmi are discussed above. Tokuda, Otsubo, and Ohmi do not teach plural slots of the microwave radiating antenna where the plural slots in the peripheral direction are closed.

Tsuchihashi teaches a similar microwave plasma generating device (Figure 20, 21; column 11, lines 37-49) including plural slots ("slits" 6a-d, 10a-d) in the peripheral direction of the shutter antenna (26) where portions of the slots ("slits" 6a-d) in the peripheral direction can be opened ("A" direction; Figure 20) or closed (counter to "A" direction; Figure 20).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to replace Tokuda and Otsubo's microwave radiating antenna with Tsuchihashi's shutter antenna where portions of the slots in the peripheral direction can be opened or closed as taught by Tsuchihashi.

Motivation to replace Tokuda and Otsubo's microwave radiating antenna with Tsuchihashi's shutter antenna where portions of the slots in the peripheral direction can be opened or closed as

taught by Tsuchihashi is for distributing microwaves as taught by Tsuchihashi (column 11, lines 37-49).

Claims 16-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tokuda; Mitsuo et al (U.S. 5,134,965 A) and Otsubo et al (USPat. 4,985,109) in view of Ohmi; Tadahiro et al. (US 6,830,652 B1). Tokuda and Otsubo are discussed above. Tokuda further teaches a plasma processing apparatus (Figure 13) including a microwave (34, Figure 13; column 13, line 16 - column 14, line 5) radial line (Figure 15) slot radiating antenna / radiating surface (lower surface of 34, Figure 13)

Tokuda does not teach a specific thickness "D" (" t ", Figure 13; column 11; lines 11-25) for his dielectric plate. Tokuda does not teach a slot antenna where a part of the number of slots is closed.

Otsubo teaches a slot antenna (Figure 2) in a microwave plasma reactor (Figure 1) having a number of slots (5a) formed and distributed in the microwave radiating surface where a part of the number of slots can be closed (column 7, lines 3-15).

Ohmi teaches one end of a standing wave microwave is positioned on Ohmi's plasma exciting surface (top surface of 103; Figure 1), as claimed by claim 1, 2, 7, 8, 16, 17, 23, and 24 – "In order to prevent the discharge, the thickness of the dielectric material shower plate 103 is determined so that the gap is located at a position of a node of the standing wave of the microwave electric field. " (column 12, line 66 – column 13, line 20).

It would have been obvious to one of ordinary skill in the art at the time the invention was made for Tokuda to optimize the thickness of the dielectric plate, and for Tokuda to use Otsubo's slot antenna, with Tokuda's radial line slot configuration.

Motivation for Tokuda to optimize the thickness of the dielectric plate, and for Tokuda to use Otsubo's slot antenna, with Tokuda's radial line slot configuration is for "easy" plasma generation as taught by Otsubo (column 19, lines 35-40) and circular TE_1 microwave generation for uniform and high density plasmas as taught by Tokuda (column 9, lines 7-30). Motivation for optimizing apparatus thicknesses is for forming stable plasmas as taught by Ohmi (column 13, lines 6-15).

(10) Response to Argument

Applicant states:

"

Tokuda merely teaches a distance between dual slot antennas, not a distance between an antenna closest to a dielectric body and the far surface of the dielectric body. Tokuda fails to mention a distance between the lower surface of the slot antenna 32 and the lower surface of the quartz plate 5, and there is no mention of the thickness of quartz plate 5.

"

And..

"

The Applicants further note that the Office Action continues to cite 34 as the lower surface of the antenna and t as the distance D, even though claims 1, 2, 16, and 17 were amended to recite wherein no additional microwave radiating antenna is placed there between the microwave radiating antenna and the dielectric body.

"

In response, the Examiner has already asserted that Tokuda teaches plural slot antennas and not the single slot antenna as required by the claims. However, taking the Tokuda reference as a whole, one of Tokuda's slot antennas 34 is shown to have a distance (t + thickness of 32 + thickness of 5) between the antenna (34) and the far surface of the dielectric body (5). The Examiner also agrees that Tokuda does not teach a distance between the lower surface of the slot antenna 34 and the lower surface of the quartz plate 5.

The Examiner disagrees with Applicant's interpretation of Ohmi:

"

However, the thickness of the shower plate 103 in Ohmi is determined only so that a node of the standing wave is positioned within the gap 104 between the lower surface of the dielectric material separation wall 102 and the shower plate 103, thereby preventing the discharge at the gap 104. See Col. 13, lines 8-12. There is no mention of the thickness of the dielectric material separation wall 102 of Ohmi, which allegedly corresponds to the dielectric body of the present invention.

"

For this specific feature, Applicant's claimed invention requires that a standing wave (delimited by nodes) form between Applicant's radiating surface (first node on the microwave radiating antenna 6, Figure 1) and a plasma exciting surface (second node). The plasma exciting surface "substantially coinciding" with "the surface of the dielectric body (2; Figure 1) facing away from the microwave radiating surface". Ohmi was cited as teaching one end (node) of a standing wave microwave is positioned on Ohmi's plasma exciting surface (top surface of 103; Figure 1), as claimed by claim 1, 2, 7, 8, 16, 17, 23, and 24 – "In order to prevent the discharge, the thickness

of the dielectric material shower plate 103 is determined so that the gap is located at a position of a node of the standing wave of the microwave electric field. " (column 12, line 66 – column 13, line 20). Thus Ohmi is clear in teaching that his gap 104 is devoid of plasma by the presence of a node in this region. All waves must have at least two nodes. The location of Ohmi's second node (plasma exciting surface) is the subject of experimentation by Ohmi. Thus the location of Ohmi's second node (plasma exciting surface) as being "substantially coinciding" with the surface of the dielectric body (103; Figure 1) facing away from the microwave radiating surface (first node on the microwave radiating antenna 102, Figure 1) is believed to be an important consideration.

"Substantially coinciding" is ultimately a function of the criticality of Ohmi's thickness of dielectric plate 103. Such criticality is laboriously studied by Ohmi who shows such an optimization in Figure 8 of the thickness of dielectric plate 103 (abscissa) vs. the dependent variable (ordinate) that is sought to be maximized (maximum power yields more stable dense plasmas *in the processing region*). The maxima are discovered by Ohmi as being integer multiples of half a wavelength – $n\lambda/2$, n=0,1,2,3.... The Examiner believes that n = 0 (left-most maxima in Figure 8) corresponds to Ohmi's dielectric plate 103 thickness that is small and thereby having Ohmi's standing wave nodes or the claimed "surface of the dielectric body facing away from the microwave radiating surface" and the "microwave radiating surface" "substantially coinciding" .

As a result, Ohmi's optimization studies lend support for obviousness to those of ordinary skill in the art to optimize the operation of the claimed invention (In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980); In re Hoeschele , 406 F.2d 1403, 160 USPQ 809 (CCPA 1969);

Merck & Co. Inc . v. Biocraft Laboratories Inc. , 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied , 493 U.S. 975 (1989); In re Kulling , 897 F.2d 1147, 14 USPQ2d 1056 (Fed. Cir. 1990), MPEP 2144.05).

The remaining grounds of rejection, not argued by Applicant, and set forth by the Examiner, should be sustained based on the art supported motivations cited in the Examiner's rejections.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Rudy Zervigon (Primary Examiner, Art Unit 1792)

Rudy Zervigon
4/3/8

Conferees:

Parviz Hassanzadeh (SPE, Art Unit 1792)

/Romulo H. Delmendo/

Acting Appeal Specialist

for Jennifer Kolb-Michener, Appeals Specialist